

In-situ Studies of Batteries

Beamlines: X17B1

Technique: X-Ray Diffraction

Researchers:

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J. Rijssenbeek et al, "In-situ Spatial and Temporal Studies of Electrochemistry in Functioning Advanced Prototype Batteries ", submitted to Microscopy and Microanalysis Conference, Richmond (2009)

Motivation: In-situ x-ray diffraction has proved valuable in probing the basic electrochemistry in thin cells designed specifically for typical energy x-ray experiments. Energy dispersive X-ray diffraction (EDXRD) provides an excellent platform for 4D-mapping (3D-spatial plus time/charge-state evolution) measurements of the internal electrochemistry of functioning commercial batteries.

Results: In situ studies was performed on liquid- $\text{Na}/\text{MCl}_2 \rightleftharpoons \text{NaCl}/\text{M}$ cells ($\text{T}=\text{Ni}/\text{Fe}$) that are prototypes of batteries designed for hybrid diesel locomotives. EDXRD measurements show great promise in revealing local electrochemical kinetics in unprecedented levels of detail deep inside of commercial size batteries.

- Cross-sectional x-ray diffraction patterns taken at various times during charging of a $\text{Na}/\text{MCl}_2 \rightleftharpoons \text{NaCl}/\text{M}$ battery
- Selected partial diffraction patterns at differing charge times showing specific Bragg lines, for the NaCl , MCl_2 , and Na_6MCl_8 phases.

